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ABSTRACT

A study examined how children visualize, draw, and make inferences about story content presented either aurally on tape or as an animated film. Audio versions of the story were manipulated to include short descriptions, in either literal or nonliteral language, directly analogous to the film's visual depiction at four points in the story. These points were chosen to examine medium effects in children's visualizations of the appearance, movement, and affect of character as well as specific points of view. Forty-five fourth grade children were assigned to either a literal audio, nonliteral audio, or film condition and individually presented the story. Afterwards, they drew and talked about their visualizations and answered inference questions about related story content. The subjects' drawings were compared with those made by children in a baseline sample to assess the degree to which they included conventional ideas and prototypes in their depictions. Results provided evidence for the capacity of visual media to encourage children to visualize and draw story content in nonstereotypic ways and to provide them with numerous visual "reference points" for understanding content. In contrast, aural media afforded children the opportunity to apply their own ideas and experiences to the interpretation and visualization of stories. (Appendixes contain materials used in the study.) (FL)

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HARVARD PROJECT ZERO

Longfellow Hall
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Technical Report No. 23

CHILDREN'S PRODUCTION AND APPLICATION OF STORY IMAGERY: A CROSS-MEDIUM INVESTIGATION

by

Martha M. Vibbert and Laurene K. Meringoff

Issued: October 1981

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Abstract

A study was conducted to examine how children visualize, draw, and make inferences about the same story content presented either aurally on tape or as an animated film. Audio versions of the story were manipulated to include short descriptive phrases, either in literal or non-literal language, directly analogous to the film's visual depiction at four points in the story. These points were selected to examine medium effects in children's visualizations and interpretations of 1) character appearance, 2) character movement, 3) character affect, and 4) specific points of view.

Forty-five 9-10 year-old children were randomly assigned to either the literal audio, non-literal audio, or film condition and individually presented the story. Afterwards, children were asked to draw and talk about their visualizations and answer and substantiate inference questions about related story content. Drawings were compared with drawings of the same content from a matched baseline sample to assess the degree to which children in the study included certain conventional ideas and graphic prototypes in their drawings.

Children who listened to the audio versions of the story produced drawings which, in their inclusion of conventional content and prototypical style of depiction, were more similar to those of baseline children. In comparison, film viewing children more often produced drawings that reflected their attempts to accurately render the film's depiction of character appearance, facial expressions, and unusual viewing perspectives. Listening children more often drew upon their outside-story knowledge and personal experiences to substantiate story inferences, while film children demonstrated

their ability to accurately recall and meaningfully apply inside-story visual information to their inference making. Listening children generally did not make use of the relevant descriptions manipulated in audio versions; nor did it matter whether these descriptions were presented in literal or non-literal language.

The results provide evidence for the capacity of visual media to encourage children to visualize and draw story content in non-stereotypic ways and to provide them with numerous visual "reference points" for understanding content. In contrast, aural media afford children the opportunity to apply their own ideas and experiences to the interpretation and visualization of stories. The report includes discussion of methodological limitations as well as suggestions for future cross-medium research.

Children's Production and Application of Story Imagery: A Cross-Medium Investigation

Martha M. Vibbert and Laurene K. Meringoff

Introduction

Imagine two children encountering a classic Grimm fairytale, The Fisherman and His Wife. The children are the same in age, sex, socioeconomic status, and learning ability. What differs is the medium in which each child experiences the story: one child sits next to her family's radio and listens while the other child sits before her family's television and watches. The same story is delivered auditorily in both cases, complete with narration, character voices, sound effects and music. But while the listening child may have to close her eyes to visualize the story's characters, settings, and events, the TV viewer has only to attend to the rich visual world on the screen in front of her. Although both attend to the same storyline, the listener may imagine her last fishing trip with a favorite uncle, while the viewer may be engaged in watching a fisherman catching fish in an unfamiliar way.

Many theorists and researchers have been concerned with the ways in which different media represent knowledge and create unique symbol systems. These differences in both the form and content of media challenge audiences to develop highly specific cognitive skills for decoding information presented in different media (Gardner, Howard, & Perkins, 1974; Gombrich, 1972; McLuhan, 1964; Salomon, 1979). In an effort to gain empirical evidence about the effects of media on story apprehension, Meringoff (1980) compared children's learning from a picture-book version of an African folktale

with that of an animated videotape of the same story.

Different "learning profiles" were observed depending on the medium of story presentation. Children who had seen the videotape version of the story included more story actions in their retellings and relied more on visual content as the bases for their story inferences. Children presented the picture book based their inferences more on textual content, outside-story knowledge, and personal experience, and their retellings included more of the poetic story prose. Similar learning differences following picture book and videotape presentations of another story also have been reported for younger children (Kelly & Meringoff, 1979). The greater recall of story action by children exposed to videotape also has been documented by Char and Meringoff (1981). This study compared children's experience with a story presented in videotape, picture book-record, or audio form. Finally, researchers have investigated the same issues using film and audio presentations. As was predicted on the basis of Meringoff's study, film children more often based story inferences on visual information while radio children relied more on general knowledge and personal experience when justifying their inferences (Gat, Beagles-Roos, Geber, & Greenfield, 1981).

The present study differs from these earlier investigations in three major ways. First, the focus here has shifted away from children's verbal retention and understanding of stories, towards children's visualizations of story content and their understanding of content that is primarily visual in nature. Having documented that film children use film's visual in reasoning about a story, basic questions about children's experience with visual aspects of stories in different media required investigation: Do children who have seen a story on film later mentally represent the

appearance of story characters and events? To what extent are these visualizations called upon when children are asked to make inferences about story content: that is, when they are asked to go beyond explicit story content and fill in missing details? For example, will a child who has viewed a film visualize a character's facial expression in order to make an inference about how that character felt? Will she rely instead on other cues such as narration, dialogue or tone of voice? Conversely, to what extent are children who have listened to an audio story inspired by verbal description to generate visual images of story content? Are story visualizations more vivid depending on whether children hear verbal descriptions in literal or non-literal language? How will audio children's visualizations differ from film children's? Is imagined visual content similarly informative for audio children when they are asked to make story inferences?

The second way in which the present study differs from previous ones concerns the choice of response measures. In light of the present emphasis on subjects' story visualizations and related inferences, measures were designed to include non-verbal tasks. Specifically, children were asked to draw as well as to describe their story visualizations. It was hoped that a graphic response mode would allow subjects to communicate their visualizations more directly without having to translate such information into words. This procedure has the effect of circumventing the conventional reliance on verbal and behavioral response measures (Bandura, Ross, & Ross, 1963; Singer, Caldeira, & Singer, 1977; Wright & Huston-Stein, 1979), while it enlarges the domain of media effects that can potentially be observed (Schramm, 1977). Through pilot testing, the present researchers developed a series of drawing and related verbal tasks appropriate for

audio and film stimuli, and non-threatening and fun for children (see Meringoff, Vibbert, and Brown, in press; Vibbert and Meringoff, 1980.)

Finally, this study differs from others with regard to the choice and construction of stimulus materials. Earlier studies have used film soundtracks as an audio story version. While such a choice preserves a high degree of experimental comparability between film and audio conditions, it also creates a limited opportunity to generalize about findings (Schramm, 1977). A film's soundtrack was never produced to stand alone as a true audio or radio story and its dependent status often renders it sparse in words where an actual radio story would be rich and vivid in description. For this reason, the present investigators rerecorded audio versions that offered "analogous" verbal description to the film's images in four preselected places, while holding all other variables such as music, sound effects, narration, and characters' voices as constant as possible. These four manipulations allowed for a much more rigorous examination of potential medium differences in children's story visualizations. The four places where analogous verbal descriptions were added to the audio versions were chosen according to the following observations and predictions about strengths and limitations of visual and audio media.

1) Character Appearance

Films visually depict all kinds of information that audio stories may or may not offer in description (Chatman, 1980). Consider the fisherman in Grimms' fairytale. Throughout the story, he necessarily looks a certain way, wears certain costumes, and interacts with different physical contexts. The decisions that this film director made about how to depict the fisherman suggest important information about the character's stature, age, ethnic background, and personality. The fisherman's costumes provide clues as to

his social class, taste, and historical context. The setting in which he lives helps us to know about the time and place of the fairytale as well as suggesting details about the quality of the characters' lives. Had the director chosen to obscure the fisherman's depiction, this too would have been conspicuous and could have been interpreted as a sophisticated form of characterization.

Authors of audio stories have more choice regarding the inclusion of description about a character's physical appearance and the information it implies. The fisherman's appearance can be described in vivid and meticulous detail, suggested more subtly through tone of voice, or only implied by music or sound effects. It also can be ignored and left entirely up to the listener's imagination. Note too that when a character is described verbally, the description typically comes in the beginning of a story and usually arrests or "freezes" the progress of the narrative (Chatman, 1980). In this sense, audio description differs qualitatively from the spontaneous and ongoing nature of visual depictions, even when care is taken to make the content of verbal descriptions as identical as possible to visual information.

Given these observations about the portrayal of characters' appearance in different media, the following expectations emerged. It was predicted that children presented the film would display more story-specific costume and appearance details in their visualization of the fisherman than children who listened to the audio story version, since film children would have had access to information presented repeatedly over the course of the story.

Visualizations of the fisherman following audio versions also were expected to include appearance details since these children heard analogous description. However, it was predicted that these visualizations would more closely resemble prototypical and non-story related images of

fishermen. Relatedly, it was hypothesized that film viewing children would more often use visualized information about character appearance as clues for inferences about story time and setting than listening children, who instead would be more likely to apply outside-story knowledge and personal experience.

2) Character Movement

Research has documented that televised actions can affect children's subsequent behavior (Bandura, Ross, & Ross, 1963; Watt & Krull, 1977), and increase the likelihood that they will spontaneously gesture when retelling a story (Meringoff, 1980). In comparison to audio stories where information about movement must be conveyed through verbal description and sound cues, films depict characters and objects in ongoing motion. For example, the fisherman casting his net is a behavior easily rendered repeatedly in drawn animation, while it is more challenging to capture in the "frozen" form of descriptive language. For these reasons, it was hypothesized that children who had actually seen the fisherman cast his net on film would be better able to convey a sense of motion in their drawings and visualizations than children who listened to verbal description of the same movement. In addition, at issue was the question of whether children can learn anything substantive about a character's physical abilities or emotional temperament from continuous observation of the quality of that character's movement.

3) Character Affect

Visual media have the advantage of being able to display a character's facial expression over time; in so doing the viewer's attention can be directly focussed on a character's changing affective state. Consider the wife in Grimms' fairytale. Her emotional state changes during the course of the story from a contented and happy woman to an enraged greedy tyrant.

This affective development is highlighted in the film through a sequence of profile close-up shots that render the wife's facial expression with successively greater exaggeration; from wide eyes and a smile to beady eyes and a vicious grimace.

Audio stories may verbally describe a character's emotional state in a variety of ways: by labeling the emotion (e.g., she felt angry), by describing the behavior or "look" accompanying an emotion (e.g., she opened her mouth wide, showing her big white teeth and her eyebrows turned down), or by reference to a metaphor or simile (e.g., her face looked like a hungry wolf). However, there is considerable evidence that elementary school aged children rely to a great extent on visual cues for understanding the world. For this reason, we predicted that children who had viewed a close-up shot of a character's facial expression would be more likely to retain and reproduce such a distinctive image in their own drawings than children who had heard descriptions of the way the character's face looked. Moreover, due to the impact of the film's visuals, we predicted that film children would be more likely than audio children to make appropriate inferences about how the wife felt at the end of the story and that these inferences would be based to a large extent on her facial expression depicted in the film. We expected fewer audio children to base their inferences on descriptive language about her facial expression.

4) Point of View/Special Effects

A film story of necessity depicts characters from specific perspectives or points of view. Depending upon decisions made about the position of the camera in relation to the subject, a character can be shown frontally (like the fish in this fairytale), in profile, in three-quarter view, from above, from below, or in various combinations of these angles. In fact, this production feature is embedded in our earlier discussions of character appearance, movement and affect.

Special visual effects in films are used to create illusions and/or to enrich the viewer's perceptual experience. For example, the magic fish in Grimms' fairytale is continually depicted with an effervescent glow surrounding it. This increases the viewer's appreciation of the fish's magic and unreal qualities.

While audio stories may describe or suggest the perspective from which something is viewed by a character, they are not required to constantly direct an audience's visual point of view. Neither do audio stories typically lend themselves to minute and continuous descriptions of visual effects.

Based on these medium characteristics, it was hypothesized that film viewing children would more often include unusual cinematic points of view and special effect features in their drawings of the fish than audio children who heard verbal descriptions of the same information.

5) Literal Versus Non-Literal Descriptive Language

In addition to the four medium difference predictions above, one more question was addressed in the present study, specifically relating to audio story presentations and descriptive language. Do children who hear a story recognize, recall, and apply to drawings descriptive information (e.g., about characters' appearance, movement, affect and point of view) more readily when it is verbalized in literal or non-literal form? Does visualizing in response to non-literal language improve with age?

Method

Subjects

Forty-five fourth graders between the ages of 9:1 and 10:9 took part in the study. This age group was chosen for two reasons. First, pilot testing revealed that fourth graders could competently grasp the story-line and that they were less inhibited than older children about having an experimenter watch them draw. Second, research on the development of drawing skills has marked this age as a transition period . During the elementary years children begin to command more technical control over their drawings. For example, by the age of 9 many children are able to represent figures in motion (Goodnow, 1977) and many show rudimentary attempts to render objects in perspective (Willats, 1977). Children, by this age, exhibit fewer individual differences in their drawings and apply more predictable strategies in the way that they draw (Gardner, 1980).

Subjects were recruited from classrooms in two ethnically heterogeneous public schools in Watertown, MA. Roughly equal numbers of boys and girls were randomly assigned to one of three medium conditions: non-literal audio, literal audio, or film.*

When screened for their familiarity with the story, all subjects were found to be unfamiliar with the experimental audio and film versions. Fifty-six percent were familiar with some other version of the story, usually from a book; however, the majority of these subjects (56%) reported no recall of any pictures from the story.

Story Materials

We selected Grimms' The Fisherman and his Wife for this study because it is a classic well-formed fairy tale. The plot is briefly summarized as

* Hereafter children in both the literal and non-literal audio conditions will be referred to simply as "audio children", except in cases where making a distinction is important. Children who viewed the film will be referred to as "film children."

follows: A poor fisherman catches a magic fish who grants wishes. He summons the fish repeatedly to relay to it his wife's ever-greater demands: to live in a city-house, to be a queen, to be archbishop, and finally, to be ruler of the universe. The fish fails to grant the wife's last wish, and instead returns the couple to their original hut, where they live out the rest of their years and never again see the magic fish.

The animated film version we used (Bosustow Production, 1977) is adapted from Eric Carle's Storybook (Franklin Watts, 1976), and has been broadcast on educational television (e.g., Massachusetts Educational Television) for several years. As described earlier, the animated film makes use of pictorial and cinematic techniques typical of the medium including fluid movement, close-up shots of characters' faces, unusual frontal perspectives, and special effects (e.g., the effervescent glow around the fish facing front). The film is 10 minutes long.

Given our intention to present the story aurally, it was essential that the film's soundtrack be complete and sufficiently well-produced to tell the story by itself. The Bosustow soundtrack provides a full storyline and in so doing makes use of narration, character voices, sound effects, and alternating musical themes.

Two audio versions of the story were rerecorded, each one preserving the original Bosustow story-line, voice qualities, music, and sound effects while adding brief descriptive phrases either in literal or non-literal language form. These descriptive phrases were analogous to the film's visual information and occurred in the narrator's voice at precisely the time in the story when they would occur in visual form on the screen. (The audio versions were each 10 minutes long, the same length as the film.)

The first added description referred to the physical appearance of the fisherman:

Audio Literal: He had a rugged face, with dark eyes, straight hair and a big curved nose. He always wore wooden shoes and a hat to cover his head.

Audio Non-literal: He had a rugged face, with dark eyes, straight hair and a nose that looked like a parrot's beak. He always wore wooden shoes and a hat to cover his head.

Film:

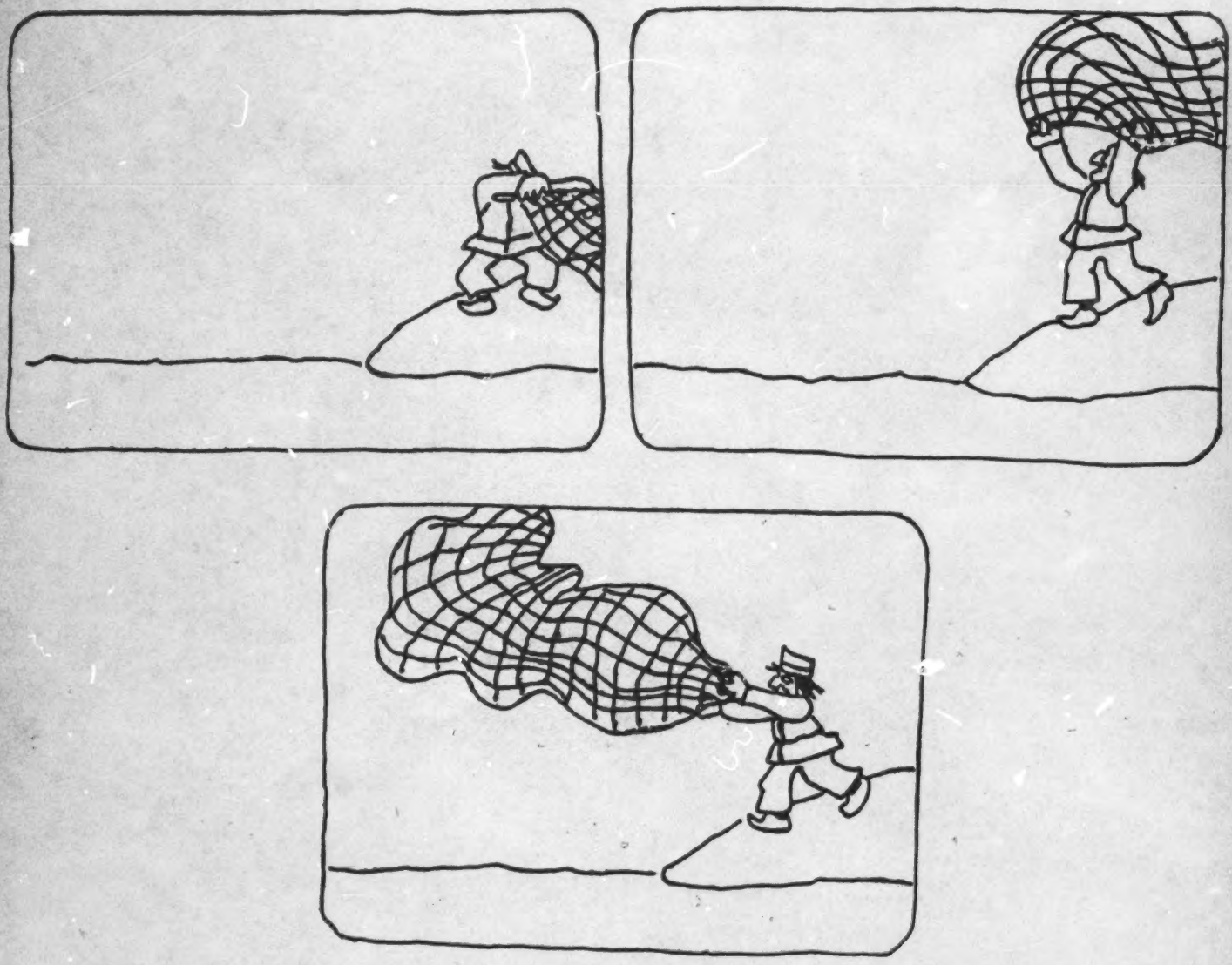
© The Fisherman and his Wife, Bosustow Productions, 1977.

The second description referred to the quality of movement as the fisherman cast his net.

Audio Literal: Each morning he went down to the shore and lifted his net high above his head and flung it out over the sea where it gently floated down for fish.

Audio Non-literal: Each morning he went down to the shore and cast his net for fish -- he looked like a person getting a bedspread to fall evenly over a bed.

Film:



The third description referred to the wife's facial expression as she demanded her last wish:

Audio Literal: She turned to him and opened her mouth wide showing her big white teeth. Her eyebrows turned down and she said...

Audio Non-literal: She turned to him. Her face looked like a hungry wolf and she said...

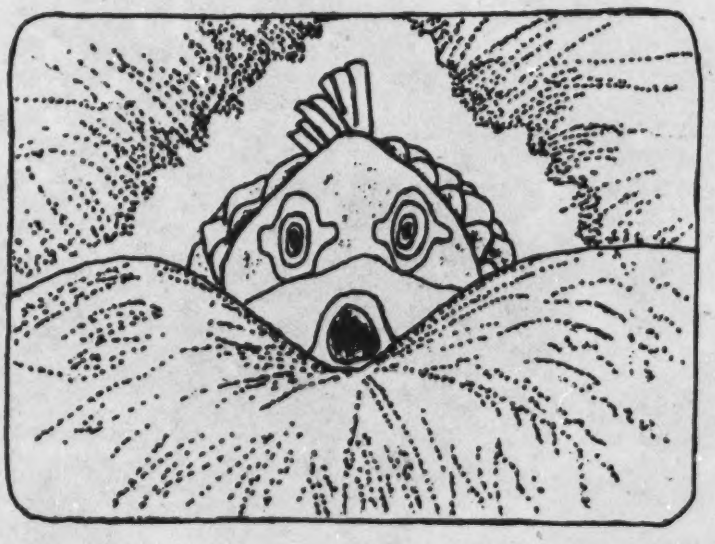
Film:

The fourth description referred to the point of view from which the fish was observed and the special effect glow that surrounded him:

Audio Literal: A shimmering glow surrounded the fish as his face peered out of the water.

Audio Non-literal: The fish looked like the bright sun beaming out from between the clouds.

Film:



Note that descriptions did not offer inferential information (e.g., she was mad) beyond that which the visuals offered. Descriptions were restricted to vocabulary and experience that would be familiar to ten year olds. Wherever possible, non-literal descriptions were simple visual similes.

Procedure

Children were individually interviewed at their schools in an empty classroom or office. Following brief conversation and screening questions, the experimenter explained that "...After you watch/listen to the story, we'll do some things with pictures and talk some about it..." Children then either listened to a cassette tape of the story or watched the film projected to the size of a television screen (15" x 20") from a viewing distance of roughly seven feet. Following the story, subjects were engaged in a series of tasks that lasted roughly 45 minutes. Verbal responses were recorded verbatim. A sample interview is included in Appendix A.

Nonverbal Measures - Drawings

In order to test our predictions about medium differences in children's story visualizations, after the story we asked children to draw their imagined "pictures" of the four relevant places in the story where information had been presented either through description in the audio versions or through illustrations in the film. These drawings were made in response to short verbal cues presented by the experimenter (e.g., "Remember how the wife looked when she told her husband the last wish? Think until you see her in your mind. Try to draw, just the best you can, how she looks in your mind...."). To preserve continuity with the storyline, drawings were done in the same order in which story events had occurred; 1) character appearance -

fisherman; 2) character movement - fisherman casting his net; 3) character affect - wife making her wish; 4) point of view/special effects - fish answering fisherman the last time. All drawings were done on 8" square white paper with #2 eraser pencils. The experimenter discreetly measured the length of time it took a subject to complete her drawing (time-to-draw score). Due to time constraints, children were encouraged to "finish up" after three minutes.

Baseline Drawings

Our predictions included the expectation that audio subjects would be more likely than film children to include prototypical characteristics in their drawings, such as simple undefined facial features and non-cinematic points of view and orientations. In order to be more fully informed about children's drawing prototypes for fishermen, angry women, and fish at this age, we collected baseline drawings from a matched sample of fifteen children, unfamiliar with any form of the story, during a regularly scheduled art class. Subjects were asked to draw content relevant to each of the four experimental drawing tasks without the benefit of any story context. (See Appendix B for a detailed account of baseline instructions.) These data provided another valuable point of reference for drawing analyses; film children's drawings could be compared both against audio and baseline children's drawings.

Verbal Measures

We reasoned that by having children draw, we enabled them to report their visualizations in a modality more closely matched to the information being sought. However, researchers have cautioned against ascribing a simple one-to-one correspondence between children's mental imagery or visualizations and their drawings (Kosslyn, Heldmeyer and Locklear, 1977). For this reason, we gave children a variety of opportunities to

talk about their visualizations and qualify their drawings. This allowed for more opportunities to evaluate whether the medium of story presentation influenced the nature and extent of children's visualizations.

"Top-of-the-Mind" Visualizations

Children were given an opportunity to talk about their story visualizations unencumbered by the production demands of drawing or the influence of later questions. Immediately following the story, subjects in all conditions were asked if "one picture in the story stands out right now in your mind - you know that you see (up there) in your mind?" If a subject responded "yes", she was asked to describe what the picture was and where in the story it came from (beginning, middle, or end).

In order to get a very crude index of how vivid children's visualizations were before they drew them, children were asked, before each drawing task, "Is the picture in your mind clear or fuzzy?" All drawings were followed by a discrepancy question: "Is there anything in your drawing that you would like to 1) change, 2) add, or 3) leave out (order rotated across children) from your drawing, so that it would be closer to the way you imagined it would look?" If a subject responded yes, she was asked to describe the particular way in which she would alter her drawing.

Finally, the source of all subjects' visualizations following each of the four drawing tasks was solicited, "How did you know the (fisherman, net, wife, fish) looked like that?" or "How did you know to imagine it that way?"

Inference Questions

In order to examine the role of aural description and film illustration in children's verbal understanding of stories, a number of inference questions were interspersed throughout the interview. Inference questions

were designed to solicit children's understanding of a variety of non-explicit content, including story setting, character age, character emotions, etc. One inference question was asked only of film children to determine if they could infer about a character's physical and psychological state from the way he moved.

In each case, relevant information carried either in the film's images or in the added verbal description was available as evidence to substantiate the inference. For example, one question about the story's setting ("Where do you think the fisherman was from?") required that a child go beyond explicit content and draw a logical inference. For a film child an inference (e.g., "He lived in Holland,") could be based on inside-story visual costume information (wooden shoes) whereas a radio child could base the same inference on inside-story text information ("He always wore wooden shoes."). Following each inference question, children were asked to describe the basis for their responses ("How did you know that?").

Aural Recall and Recognition Questions

At the end of the interview, children who heard either the literal or non-literal audio versions were presented with two short tasks to assess the degree to which they remembered the four language manipulations. This assessment was necessary for a full understanding of the sources of these children's visualizations and inferences.

To tap subjects' recall, they were first asked to describe anything in the story that told them how (requested story content) looked. For example for Description 2 - Character Appearance, children were asked, "Did it say or describe anything in the story about how the fisherman looked?" Children's responses to the four recall questions were probed for select details, e.g., "Did it say anything about his clothes?".

Recall questions for each of the four descriptions were followed by a recognition task, in which subjects selected the phrase they thought they heard from among four alternatives written on index cards randomly arranged in front of them and read to them by the experimenter. For example, choice alternatives for Description 2 were as follows:

Correct Choice for Audio Literal Child:	(See description of audio stimuli, p. 11)
Correct Choice for Audio Non-literal Child:	
Incorrect Literal Choice:	He went down to the shore and dragged his net along the sand until it plopped heavily into the water.
Incorrect Non-literal Choice:	He went down to the shore and cast his net for fish - he looked like a mailman throwing a heavy sack of mail.

To provide data about adults' ability to recall and/or recognize descriptive story language, six adults were individually interviewed following presentation of either the literal or non-literal audio versions.

Scoring

Drawings

All drawings (including baselines) for Task 1 (Character Appearance), Task 2 (Character Movement), Task 3 (Character Affect), and Task 4 (Point of View/Special Effects) were scored for the presence or absence of specific content (e.g., fisherman, costume detail, net and waterline [see Appendix C for a complete list of scoring categories for drawings]). Drawings also were classified according to such features as size and orientation of figures, degree of filled-in space, and quality of line (e.g., jaggedness). These scoring categories derived in part from earlier

pilot work (see Meringoff, Vibbert, & Brown, submitted for publication; Vibbert & Meringoff, 1980) and in part from consideration of the film medium's potential effect on both the form and content of graphic products.

An independent judge achieved mean reliability (across categories) with the experimenter scores of 95% (Task 1), 94% (Task 2), 96% (Task 3), and 97% (Task 4), based upon 25% of the data. The percentage of agreement obtained in scoring individual categories ranged from 83% - 100%. Differences in scoring were resolved through discussion.

Drawings of the wife telling her husband the last wish (Task 3 - Affect) were further analyzed by two independent judges blind to condition. The judges classified drawings of the wife according to the overall emotional expression in the wife's facial features and/or posture. Drawings were sorted into three categories: happy, sad, or indistinguishable. The indistinguishable category included those drawings where it was not clear how to interpret the wife's expression; e.g., she looked startled or excited. Interscorer agreement was 83% and disagreements were discussed and resolved.

Verbal Responses

Discrepancy responses were examined to determine the reasons for children's dissatisfactions with each of their four drawings. Data were categorized according to whether children remarked about their general drawing ability (e.g., "I can't draw good") and whether they offered specific comments about their rendering of such elements as figures, costume, affect, context, or formal features (e.g., "It should have color."). The total number of responses for each child per drawing was recorded along with an indication of how many items a child wanted to add to and/or change in her drawing. Twenty-five percent of discrepancy data were scored by an independent judge, and 85% agreement was achieved. Scoring differences were discussed and resolved.

Children's responses to the source question, "How did you know (requested story content) looked like that?" were scored according to the system described below for inference bases data. Basically, source data were categorized according to whether children used inside-story information (e.g., "I knew he looked like that because I saw/heard he had a curved nose."), outside-story information (e.g., "I knew it looked like that because I learned how to cast a net from my father."), or whether they inferred something further about the story (e.g., "I knew the fisherman looked like that because I think he was old..."). A list of subcategories within inside, outside, and inferred categories with examples is included below.

Eighty-eight percent (88%) agreement was achieved with an independent judge who scored 25% of all source data. Disagreements were discussed and resolved.

Responses to inference questions, e.g., "How did the wife feel when she told her husband the last wish?" were grouped by content (e.g., positive, negative, or other affect) and summed for each condition. Inference bases (responses to the question, "How did you know she felt like that?") were coded according to whether they referred to inside-story, outside-story, or inferred story information. A child's response could include more than one scorable unit. (This same system was applied to visual source data.) Subcategories for bases are listed below together with examples:

Inside Story

Auditory: ("I knew it was England) because it sounds like he (had) an English accent."

Textual: ("It was Cape Cod) because he says, 'go down to the beach....'"

Visual: ("Scotland), because he kind of looks like that kind of person."

Visual/Textual: ("England)...because there was a castle." (Content like the "castle" was available both in the film's visuals and text.)

Outside-Story

General Knowledge: ("It was Russia) because they do a lot of fishing over there."

Personal Experience: ("Virginia), because a friend moved to Virginia and I've seen pictures."

Inferred About the Story

Physical: ("It was easy to throw the net) because the net was light."

Psychological: ("I knew the wife felt happy) because she thought she could get the wish."

Children's inference basis responses for the wife-affect question were additionally scored for their location in the story, to capture whether the basis referred to the relevant place in the story (e.g., ["I knew she was mad] because she was shouting and showed the teeth-like!") or whether it referred to events across the storyline as a whole (e.g., ["I knew she was angry] because first she wanted a house, then to be queen, then to be bishop...and then...to be god.").

One quarter (25%) of the inference bases data for each question were scored by an independent judge. Average agreement of 91% was reached (range = 83% - 100%). Disagreements were resolved through discussion.

Inference bases data also were categorized according to the content of a subject's justification, independent of the score it received along the inside-outside dimension. Content categories shifted somewhat with each question, and included references to figure, costume, setting and story events.

Recall and Recognition Tasks (audio conditions)

Subjects were given one credit if they recalled at least one vocabulary word or synonym from the original language manipulation.

One recognition credit was given for each of the four tasks if a subject selected the appropriate language manipulation from among the four alternatives. Ninety-two percent (92%) agreement was attained when an independent judge scored one third of all recall data. Disagreements were resolved through discussion.

Analyses

Chi square tests were performed on all four drawing and verbal discrepancy tasks by category to determine condition effects. A separate one-way analysis of variance with one between-subjects factor (medium) was performed on the total number of discrepancy responses, the total number of "add" comments, and the total number of "change" comments for each of the four drawing tasks. (There were too few "leave out" comments to analyze.) One-way anovas also were performed on time-to-draw data for each drawing task.

In order to examine source data for each drawing task, one-way anovas were performed on the total number of outside-story categories used by each subject. However, anovas were not performed on total number of inside-story categories used. Given that neither visual nor visual/textual information was available to audio children, there was less probability for these children than for film viewers to use inside-story categories. Orthogonal contrasts examining differences between collapsed audio and film condition means also were conducted. Chi square tests were performed on subjects' use of specific inference and outside-story categories.

Inference bases data were analyzed using chi square tests on subjects' references to outside-story categories. In order to evaluate differences in the content of inference bases, chi square tests were conducted on subjects' references to character costume, figure, movement, context, etc.

Finally, t tests were conducted to compare the mean number of correct recall and recognition credits for subjects in the literal and non-literal audio conditions. Separate tests were performed for each of the four recall and recognition tasks. T tests for matched pairs determined differences between recall and recognition means within each audio condition.

Results & Discussion

Testing for Story Visualizations

Regardless of the medium in which they experienced the story, the great majority of subjects (89%) reported and described a "top-of-the-mind" story visualization. Reports of these initial, post-story images covered a range of story content and there were no medium differences in either their length, location within the story, or content. Typical descriptions included, "I see the wife with an old dress on in the old hut"; "I see the guy fishing with the net and the flounder coming out of the water and the net and him asking the wish"; and "...the fish — it's gold and has big eyes". Further, the majority of children in all conditions reported that their visualizations of the four cued points in the story were "clear".

Additional evidence of subjects' story visualizations is provided by an examination of verbal discrepancy data. Regardless of medium presentation, the majority of subjects reported some discrepancy between the content of their story visualizations and their drawings in 3 of the 4 drawing tasks. (Literal=73%; non-literal=69%; film=69%: percentages are derived from the mean number of subjects who reported discrepancies across these tasks.) The exception to this was on Task 4 where all children reported fewer discrepancies.

Taken together these findings suggest that all children, regardless of medium presentation, had ready access to internal visual referrents as they talked about and drew specific points in the story. Audio and film children alike appeared to easily grasp the function of discrepancy questions, and to welcome this opportunity to acknowledge the inability of their graphic products to adequately capture the true nature of their story visualizations. The exception to this was on Task 4 where children were asked to draw their visualizations of the "last time the fish says,

'Go home!'" Perhaps because it was so much easier to draw a fish than a person, children's drawings of fish more closely approximated their visualizations.

Although these data suggest that children do visualize story content and can describe those visualizations, many questions are still left unanswered. For example, do audio children spontaneously image during a story's progress and is this imagery of a different sort than that which they report in response to specific requests? Do children who view a film simply take in visuals whole or do they subsequently alter them to store more story information? Further information about the function of visualizations in children's story comprehension is provided by drawing data.

Character Appearance

Drawings: Table 1 summarizes the results of Task 1 drawings where subjects were asked to draw their visualizations of the fisherman. Typically, children responded to this task by producing a full male figure (as opposed to just a face), roughly 2-4 inches high. Analyses of the inclusion of story specific character appearance details yielded some suggestive results:

Table 1 Drawing the Fisherman --- Character Appearance Details

More film Ss include than audio and baseline Ss	More film Ss include than baseline Ss; audio Ss in between	Level of Significance
straight hair		χ^2 (6)=13.41 $p \leq .05$
	elaborated costume (e.g., shirt w/buttons, pockets)	χ^2 (1)=5.0 $p \leq .05$

Table 1 (cont.)

long nose	χ^2 (1)=3.60	$.05<p\leq.10$
elaborated facial features (e.g., eyebrows, wrinkles)	χ^2 (2)=3.43	$.10<p\leq.20$

In addition, a significant relationship was found between medium presentation and drawing hats on the fisherman ($\chi^2(3)=8.78$; $p\leq.05$). Fifty-three percent (53%) of film children drew the fisherman without a hat, while the great majority of all other children drew him with a hat. Also, more film and audio children drew the fisherman without a background than baseline children (χ^2 (3)=13.77; $p\leq.01$). Film children drew the fisherman without any physical context most often. There was no greater tendency for children in either medium condition to draw shoes recognizable as wooden. Very few children attempted to do this perhaps because the upwards curve of wooden shoes was too difficult and subtle for children to render graphically.

The results indicate a consistent tendency on the part of film children to include more of the visual details of the fisherman's appearance in their drawings (e.g., his long nose, rugged face, straight hair, etc.) than baseline and audio children. As would be expected, these differences in detail inclusion are most striking between baseline and film children while audio children usually fall somewhere in between. This suggests that regardless of the availability of language description, children who listen to audio stories may visualize characters according to the prototypical images with which they already are familiar. Some support for this is found in the finding that baseline children felt compelled to draw the fisherman with a hat, while film children, who had seen the character with and without a hat overcame this convention

and were just as likely as not to draw one. Also, note that film children least often drew the fisherman against a background. Perhaps for these children the character was more significant in his own right and specific details of his appearance were sufficiently challenging to render. It was not necessary for them to include the objects conventionally associated with fishermen (e.g., boats, water, fish) in order to "complete" their visualizati... Also, film children may have recalled a number of shots of the fisherman without context such as the close-ups of his face which appeared when he was summoning the fish.

These results are consistent with the earlier observation that descriptive language cannot carry the density of information available in ongoing visual depictions. Although information about how the fisherman looked was conveyed in the audio version of the story, it occurred only once, at the beginning of the story and was presented successively ("he had a rugged face, straight hair, and a long curved nose..."), rather than simultaneously in a visual depiction. Perhaps film children have the advantage in recalling physical appearance details because this stored picture of the fisherman is easier to retrieve than a verbal list.

Inferences: Data from three inference questions are relevant here: 1) Setting (Where do you think the fisherman is from -- what country?)

There were no medium differences in children's actual inferences about where the story took place. Responses ranged from European countries such as England, Ireland, and Italy, to even native locations as Minnesota, Virginia, and Cape Cod. However, a chi square test confirmed the predicted trend that audio were more likely than film children to base their inferences on at least one outside-story source, e.g., general knowledge or personal experience: "I knew he came from the Cape because

they bring in a lot of fish there." (χ^2 (1)=4.22, $p \leq .05$). Further, analysis of the content of children's inference bases revealed that film children were significantly more likely than audio children to refer to the physical appearance of a character ("his shoes", "his pointed nose", "in England they have those kind of robes when they go to sleep") as a justification for their inference about story setting (χ^2 (2)=6.52; $p \leq .05$).

2) Time (What time do you think the fisherman lives in...?)

No significant medium difference was found in children's estimation of when the story took place, (e.g., whether it took place long ago or more recently). However, audio children again based their time estimates on outside-story information more often than film children (χ^2 (2)=11.13, $p \leq .01$). Also, more film children than radio children drew upon character appearance (particularly costume) as a basis for determining the time frame of the story (χ^2 (2)=6.00, $p \leq .05$).

3) Character Age (Do you think of the fisherman as a young man... as a middle-aged man...or as an old man...?)

Chi square tests performed on children's inferences about the fisherman's age approached statistical significance for film versus both literal and non-literal audio children (χ^2 (2)=5.05, $.05 < p \leq .10$). Sixty percent of all children inferred that the fisherman was middle-aged. However, more film children described the fisherman as being young, whereas audio children were more likely to call him old.

Audio children based their inferences on a variety of sources (e.g., auditory, text, further inferences, general knowledge) and again they were more likely than film children to base their inferences on outside-story knowledge (χ^2 (2)=6.07, $p \leq .05$). For example, some audio children called on stereotypic beliefs to justify their inferences: "He was old because most

fishermen are old" or "He was middle-aged because young men don't like fishing". Unlike the children who listened to the story, film children relied almost exclusively on character appearance for information about the age of the fisherman; e.g., "He was a young man because he didn't have a mustache or a beard" (χ^2 (2)=19.05, $p \leq .001$). Note that across all three inferences only 8% literal audio and 5% non-literal audio children referred to the descriptive language manipulation as a basis for their inferences.

An interesting complement to these data on the fisherman's age is provided by children's justifications for their inferences about the fisherman's size. (If the fisherman came into this room right now, do you think he would be a small man, an average size man, or a large man?) Here, film children again illustrated the application of the film's visual content in their reasoning. Interestingly, however, this was an instance where access to the visual depiction of the fisherman proved to be confusing rather than clarifying. Forty percent of film children described their inference bases in a way that indicated their bewilderment about the interaction between a character's real-life scale and the portrayal of scale in film animation, e.g., "He's average because in the movie they're usually smaller than they look"; or "He's small because in cartoons...they just can't grow".

Audio children, on the other hand, appeared to be less puzzled in justifying their inferences and displayed a high degree of resourcefulness in finding inside and outside-story clues: "He's small because of the way he talks - he has a small voice"; "He's small because they had a little house"; or He's big because my grandfather was a fisherman and he was big".

Inference data from questions 1,2, and 3 provide evidence of ways in which children can draw upon visual depictions of characters in

interpreting story content. To determine the age of the fisherman, audio children were more likely than film children to call upon stereotypic notions of elderly fishermen. Still, this was a resourceful strategy, inasmuch as no explicit information about age was provided in the audio version. On the other hand, film children had myriad visual clues to help them assess the fisherman's age. Their predominant use of this information at least temporarily overrode more prototypical notions of "old fishermen". This provides additional support for the hypothesis that children who listen to stories are more likely to visualize story characters according to their conventional ideas than are children who view more unusual depictions of characters in film.

Data from the setting and time inferences suggest that film children not only remember the details of a character's appearance but are able to meaningfully apply that information when asked to interpret a story. Visual information often helped film children make very direct connections: e.g., "I know it was Scotland because he had wooden shoes" or "In the old days they wore those kinda clothes". Audio children, on the other hand, were forced to resort to more roundabout and/or stereotypic reasoning: e.g., "It was Minnesota because they have all kinds of water", or "It was the olden days because that's when magic fishes were around".

Measured against the great extent to which film children made use of visual content as inference bases, the small percentage of audio children who based inferences on analogous descriptive language is dramatic. Perhaps because it was too fleeting, or perhaps because it was overshadowed by other non-descriptive language, audio children rarely relied on this given source of information.

Character Movement

Drawings: No significant medium differences were observed in subjects' tendency to represent movement in their drawings of the fisherman fishing (Task 2). In fact, baseline drawings more often displayed the fisherman with his arms up over his head (χ^2 (6)=16.18, $p \leq .01$). Though not statistically significant, baseline children more often drew the net above the fisherman and more often drew it extended out beyond the fisherman's hands. Both of these tendencies contribute to a sense of motion. However, these findings may be explained by an inconsistency in experimenter instructions.

In order to insure the collection of a drawing sample where nets were used for fishing, baseline children were instructed to "draw the fisherman casting a net". Children participating in the study were instead given less specific instruction, to "draw the way you see the fisherman fishing", to provide them with full latitude in constructing their visualizations. Clearly the two goals were at odds, and experimental children probably and perhaps rightfully interpreted these directions to suggest a more static scene with the net (or pole) already in the water. Therefore, it is inappropriate both to compare drawings of baseline with story groups and to make observations about the depiction of movement from these story-based drawings.

Though not directly relevant to the analysis of movement, several other findings from Task 2 drawings deserve mention. A significant relationship was found between medium of presentation and the tendency of children to place the fisherman in certaincontexts (χ^2 (12)=36.07, $p \leq .001$). Baseline and audio subjects were more likely to draw the fisherman either in a boat or at a shoreline. Instead, film children most often drew him standing at the foot of a hill in a profile-left view, as he

was depicted in the film. (Note that nowhere in the story did it refer to the fisherman in a boat . It did refer to him "going down to the shore to fish".) In addition, when the mean size of the fisherman in both audio conditions was compared to that in the film condition, film children were found to draw smaller fisherm n than children in both audio conditions ($t(40.3)=2.22$, $p \leq .05$).*

Film children's rendering of smaller figures may be a consequence of their attempts to reproduce the fisherman in context, and in scale with the hill. This again supports the claim that film children accurately recall specific shots as they visualize and draw. (The film offered many visual depictions of the "fishing scene" from a viewing distance that included the fisherman at the foot of the hill facing left.) Baseline and audio children had less reason to imagine the fisherman fishing this way, and more latitude to picture him in a boat, though this was not described.

Even more striking was the extent to which audio children's drawings contradicted the verbal information offered. In spite of the fact that the fisherman was described casting his net for fish four times in the story, 80% of non-literal and 50% of literal audio children rendered the fisherman fishing with a pole. Due to the nature of instructions, no baseline children drew a fishing pole. (However, pilot sample data included many instances of poles when baseline children were asked to "draw a fisherman fishing"). Only one out of 15 (7%) film children drew a pole.

This finding provides powerful evidence for the prevalence of previous experience and long-held beliefs when children graphically render content from aurally presented stories. Despite vivid and repeated verbal description to the contrary, when drawing, these children

* Decimal points in degrees of freedom occur due to the use of separate variance estimates in analyses.

found it difficult to give up the idea that fishermen fish with poles. Interestingly, some of the same children who described "top-of-the-mind" visualizations of the fisherman fishing with a net subsequently drew him with a pole. On the one hand, this may be interpreted as further evidence for Kosslyn's claims about the inadequacy of drawings as reflections of internal visualizations (1977). Alternatively, the same data may suggest that audio children's post-story visualizations are less enduring than those of film children.

Inferences: Two inference questions were related to the analysis of movement in children's story visualizations.

4) Net (Was it hard or easy for the fisherman to throw the net?)

Though not significant, there was a suggested medium difference in the nature of children's inference. The majority (60%) of audio children inferred that it was easy for the fisherman to throw the net, while most (60%) film children thought that it was hard.

Inference bases were difficult to analyze because of the small number of scorable radio responses. (Children who drew the fisherman with a pole were not asked this question.) However, of the children whose responses were scorable, only 20% of audio children referred to the text description of the fisherman throwing the net as a basis. In comparison, 47% of film children referred to the visual (or visual/textual) depiction of the fisherman throwing the net, e.g., "Easy, because of the way he did it--all he did was throw it over his shoulder" (child gestures).

A percentage of all children (audio=13%, film=26%) made a further physical inference about the net to justify their initial inference about ease of throw, e.g., "It was easy because the net was light" or "It was hard because it was probably a big net..." (audio).

There was no significant medium difference in the number of children who offered outside-story inference bases. Perhaps because there was limited relevant inside-story information available to any group, many children, regardless of condition, relied on general knowledge and personal experience to justify their inferences. This may also explain why some children made a further physical inference about the net itself in order to substantiate their response.

5) Fisherman's Walk (Film children only were asked whether they learned anything about the fisherman, his feelings or his body, from the way he walked back and forth to the sea.) All the children responded affirmatively. Their qualitative interpretations of the fisherman's movement were both keen and subtle: for example, "His shoulders were down and he just didn't want to go"; "He looked tired going up and down the hill. His feelings were angry and sad and he didn't get no fun out of it"; and "He looked kind of scared to keep going to ask the fish". All the responses support the notion that children who view film not only remember but meaningfully apply visual information when interpreting story content.

Character Affect

Drawings: Table 2 summarizes the results of Task 3 drawings, where children were asked to draw the way they imagined the wife looked when she told her husband her last wish...to be like God. Chi square tests revealed a significant relationship between medium of presentation and subjects' rendition of several facial features described in the audio versions and depicted visually in the film.

Table 2 Drawing the Wife - Character Affect

More film Ss include than audio and baseline Ss	Level of Significance
open mouth	χ^2 (3)=11.722, $p \leq .01$

Table 2 (cont.)

More film Ss include than audio and baseline Ss	Level of Significance
teeth	χ^2 (3)=8.20, $p \leq .05$
only face drawn	χ^2 (3)=15.00, $p \leq .01$

Drawings also were examined for one other depicted and described facial feature, turned-down eyebrows. Although they appeared in less than half of all children's wife drawings, there was a non-significant tendency for film children to include them more often. Perhaps, as with wooden shoes, this was too unusual and subtle a detail for children to render.

Independent judgements of the overall emotion conveyed by the wife figure in the drawings (happy, angry, or indistinguishable) revealed that a small percentage of subjects in all conditions (roughly 23%) rendered an "angry" wife. (Drawings were labeled indistinguishable if the judges felt that the child's emotional message was confused or too difficult to interpret, e.g., a wife is drawn with a smiling mouth while her eyebrows slant downward in an expression of anger.) However, the remainder of film subjects produced wife drawings more likely to be judged as indistinguishable than happy, while the opposite was true for drawings made by non-literal audio children (χ^2 (1)=3.84, $p \leq .05$). The same non-significant trend was observed for film versus baseline children. Literal audio children were just as likely to draw a happy wife as one judged to be indistinguishable.

The fact that film children's drawings were more often judged as indistinguishable may suggest that these children were attempting, although not entirely successfully, to go beyond the childhood convention of drawing smiles on figures. In a sense, these children may have been trying

to alter their prototypes and produce a figure that would be more like the angry one that they had seen.

Baseline and non-literal audio children were most likely to adhere to the smile convention; the majority of these children did, in fact, draw the wife with a smile. This is somewhat inconsistent with baseline instructions to draw a woman "demanding" that she be given one more thing. It also suggests that non-literal audio children's visualizations were not influenced by the offered description" "Her face looked like a hungry wolf." Had non-literal children simply been unable to adequately draw their visualizations, we would have expected these children's discrepancy remarks to reflect their desire to alter the wife's emotional expression. However, no non-literal audio child verbally qualified his/her drawing with a wish that it show more expression or anger.

That literal audio children's drawings were just as likely as film children's to be judged indistinguishable suggests that more of these children attended to story cues such as tone of voice and relevant content Like film children, literal audio children more often attempted to go beyond the smile convention and capture a more complex emotional attitude in their drawings.

With regard to the treatment of context, film children who did not draw a face alone, more often drew the wife in a bedroom where the scene took place than did audio children (χ^2 (2)=8.86, $p \leq .05$). Moreover, there was a non-significant trend for more film than audio children to draw the bed in the unusual frontal view depicted in the film. It appeared that audio children more often concentrated on the specific details of the wife's costume (e.g., her crown, ruffles, capes, etc.) and more film children attended to the details of the scene they had witnessed (e.g., the bedroom with sun rays streaming through the window).

This is consistent with the context findings for Task 2. Again, these film children included a great deal of the visual information they had received from the film in their drawing. Film children's drawings suggest that these children are able to call upon fairly extensive visualizations of scenes as they drew, complete with cinematic points of view (the frontal bed) and lighting details (the sun rays).

On the other hand, audio children seemed absorbed with rendering costume details that were neither fully described nor necessarily relevant to the story. Perhaps these children's visualizations were initially vague, or they may again have included conventional images, in this case, of queens in fairy tales.

Inference:

6) Wife Affect (How do you think the wife felt when she made the last wish?)

Responses generally fell into 2 categories, either positive (happy/good) or negative (angry/mad). A significant relationship between medium condition and affect response was discovered: More film children inferred that the wife felt angry or mad, while the majority of audio children inferred that she felt good or happy (χ^2 (2)=15.29, $p \leq .001$). Note that this finding reinforces the observed differences between baseline and non-literal audio drawings as compared with film drawings.

No medium differences were found in children's use of inside/outside-story sources as inference bases. The great majority of all children relied on inside-story sources, perhaps because for this question the application of outside-story information would have been somewhat cumbersome and inappropriate. Film children's bases relied almost exclusively on visual information specific to the precise moment in the story when the wife made the wish (e.g., "I knew she was mad because of the mean way she looked at him.") On the other hand, audio children typically referred

to textual information drawn from across the story as a whole (e.g., "I knew she was happy because she had everything: a castle, a husband, she could rule weather, a black dress, a hall painted, she got the archbishop wish...") (χ^2 (2)=8.40, $p \leq .05$). Only 1 literal audio child out of 28 (4%) audio children referred to the analogous descriptive language about the wife's expression at the moment under question while 9 out of 14 (64%) scorable film children referred to her visualized facial expressions to justify their inference (χ^2 (2)=15.42, $p \leq .001$).

The medium differences observed in children's strategies for justifying their affect inferences are particularly interesting. They again support the claim that film children readily and aptly apply visual information to meaningful interpretations of story content, in this case, interpretations of a character's internal state. (This was also illustrated by film children's inferences about the fisherman's feelings based on the way that he walked.) However, audio children did not readily apply descriptive verbal information about the wife's facial expression to their inference-making. This may help to explain why they tended to misjudge her affect as happy. Perhaps, again, the description was too fleeting to be absorbed in the course of the story plot, though this explanation does not seem complete in light of the fact that the film's analogous visual information was just as brief.

Here, findings about the specificity of children's inference bases may be particularly relevant. Perhaps it is the case that children who view films (or television) become adept at a sort of "imagistic" thinking. That is, these children may become practiced at storing highly specific story content in iconic form either as whole scenes (as was seen in some Task 3 and 2 drawings) or as highly isolated "shots" (as was seen in film drawings of

the wife's face alone). Children may become highly skilled at recalling these iconic representations when they need relevant information to draw conclusions about characters' personalities, actions and appearances. (Film producers, of course, can and do capitalize on this imagistic memory by repeating or singling out certain visuals that carry important information. This increases the probability that viewers will recall and interpret that information.)

On the other hand, the evidence showed that audio children assumed a "trans-story" stance when justifying inferences about the wife's affect; that is, instead of recalling specific scenes these children more often referred to the "gist" of the story as a whole. Audio children may be less adept at relocating specific points in story-time because they have received information in only one channel (auditory) without the benefit of visuals to reinforce or underscore it. This forces them to "roam" the story for available evidence which may or may not be appropriate for the question at hand. Also, because they have listened to a verbal story, audio children may do more "semantic recoding" (Bransford, 1979). This means that they may pare down story information into abstract representations that do not faithfully reflect the chronology of story events. Thus they may have more difficulty recollecting precise moments in story time. It may be that children who listen to stories in this age group need highly stylized sound cues (such as music and tone of voice) or explicit text (e.g., "She was furious") in order to make appropriate inferences about a character's internal emotional state.

Point of View and Special Effects

Drawings: Analysis of Task 4 drawings, when children were asked to draw their visualizations of the fish at the end of the story, revealed

a significant relationship between medium condition and the orientation of the fish on the page. Differences were significant between film and baseline children (χ^2 (2)=6.83, $p \leq .05$) and between film and literal audio children (χ^2 (2)=8.07, $p \leq .05$). Similar but non-signigicant orientation differences were observed between film and non-literal audio children. Specifically, film children were more likely than others to draw the fish frontally or in profile-right view as it was repeatedly depicted in the film. Literal audio and baseline children never drew the fish in a frontal view and all non-film children were equally likely to draw the fish in left as in right-profile. (Across all drawing tasks, film children rarely drew a character in a profile view that wasn't depicted in the film. In comparison, as would be expected, baseline and audio children showed no preference for one profile view over the other.)

While these orientation findings are not counter-intuitive, they again underscore the fact that film children have highly accurate recall of visualized story content. They also highlight our earlier claim that it is difficult for language to specify the point of view from which a character or object should be visualized. Finally, these findings may have implications for the way children learn to draw. Perhaps films that visually depict things from unusual points of view inspire children to render their own drawings (and perhaps even their visualizations) in new and non-stereotypic ways (Wilson & Wilson, 1977). (The fact that baseline children never drew the fish frontally suggests that such a view is indeed unusual.) Further, through the viewing of films, children may acquire a rich and varied repertoire of cinematic views for later reference when visualizing or drawing related content. (Indeed, audio children frequently referred to related book illustrations, film, and television show visuals when asked to describe the source of their visualizations.)

Other findings from drawing-Task 4 are summarized below in Table 3.

Table 3 Drawing the Fish - Point of View and Special Effects

More film Ss include than baseline or audio Ss	More film Ss include than baseline Ss; audio Ss in between	Level of Significance
Special effect glow surrounding the fish		χ^2 (3)=12.86, $p \leq .01$
	Detailing of scales on the fish	χ^2 (1)=7.04, $p \leq .01$
Waves in the water		χ^2 (3)=7.87, $p \leq .05$
Jagged waves (as opposed to slight or medium)		χ^2 (6)=13.18, $p \leq .05$

These findings document film children's accurate recall of the details of a character's physical appearance (scales) and special effects (e.g., glow). Apparently, the glow surrounding the fish was not salient for literal children who only heard direct reference to it once. (Film children viewed it repeatedly.) Also, the literal description of the glow interrupted a moment of heightened suspense in the story plot. As a consequence, these children may have been distracted from hearing the description.

Film children more than other children, tended to draw the details of the storm in the scene when the fish appears for the last time. For example, they often tried to suggest a lot of turbulence in the water by drawing jagged water lines. Audio children were not as likely as film children to represent the sea's jagged waves, perhaps because the film's graphic model of moving waves was a more memorable and vivid source of imagery. Relatedly, as in Task 3, they may have had more difficulty locating the fish in the appropriate specific story-time, i.e., when the "storm was raging". However, many of these drawings include rich

details pertaining to the fisherman and to the boat that audio children imagined he fished from.

Interestingly, roughly half (47%) of the baseline children included "magic accessories" (such as wands, crown, stars, etc.) in their drawings of the fish, while virtually no children in the study did (χ^2 (3)=16.08, $p \leq .001$). Baseline children may have added these costume details in order to heighten the character's identity as a magic fish. Perhaps, after getting to know the fish as a story character, children in the study did not have to rely on these more standard forms of fantasy characterizations.

Inference:

7) Other Character Features (How did you know the fish was special?)

This question simply asked children to substantiate information already given in the question. Responses yielded several medium differences. Consistent with their tendency to draw more of the appearance details given in the story, film children more often than audio children referred to the gold and silver appearance of the fish as an indication of "specialness" (χ^2 (2)=7.65, $p \leq .05$). In addition only film children referred to the special effect glow surrounding the fish (χ^2 (2)=11.29, $p \leq .01$). In comparison, audio children frequently referred to general textual information about the fish (e.g., "He said it was a magic fish and it could talk"). However, they made no use of the specific verbal descriptions of the fish offered in both audio versions and only minimal use of the story's repeated references to the gold and silver color of the fish.

Discrepancy Data (Is there anything you would like to change, add, or leave out of your drawing, so it is closer to the way you imagined it would look?)

There were no significant medium differences on any of the 4 drawing tasks in the total number of add or change comments made by children.

(There were too few " leave out" comments to warrant analysis.) Nor did analyses of the content categories to which children referred in discrepancy responses (e.g., general comment, figure, costume, setting, etc.) reveal any consistent medium trends across tasks.

The lack of medium differences in both the number and type (change or add) of discrepancy responses already has been interpreted as evidence for the likelihood that the majority of audio and film children referred to some sort of story visualization as they drew (see pp. 23-24). Other interpretations of these data also are plausible.

Perhaps by the time they were asked to articulate their discrepancies all children had lost some touch with the visualization that originally spawned their drawing. The discrepancy question then became an opportunity to simply reflect on one's drawing as an independent product. This could explain, in part, why the categories of children's remarks did not correspond with the medium differences observed in children's drawings.

In the end, it is difficult to fully understand the discrepancy data. Although children seemed to consult some internal referrents as they commented on their drawings, more sophisticated verbal and non-verbal measures are needed to accurately characterize children's visualizations of story content.

Source Data for Visualizations (How did you know to imagine [requested story content] that way?/How did you know [requested story content] looked like that?)

One-way anovas examining the relationship between medium condition and the number of outside-story categories (e.g., general knowledge, personal experience) children used as the source for their visualizations were significant for 3 of the 4 drawing tasks (Task 1: $F(2,42)=4.81$, $p \leq .01$;

Task 2: $F(2, 42)=5.02$, $p \leq .01$; and Task 4: $F(2, 42)=4.47$, $p \leq .05$). The Task 3 anova approached significance $F(2,42)=2.85$, $p \leq .07$). Orthogonal contrast revealed that audio children more often used outside-story sources (e.g., "I knew he looked like that because usually fishermen have beards.") than film children (Task 1: $t(42)=4.81$, $p \leq .01$; Task 2: $t(42)=2.83$, $p \leq .01$; and Task 4: $t(42)= 2.65$ $p \leq .01$). The comparison approached significance for Task 3 $t(42)=1.96$, $p \leq .06$).

This finding was, of course, predictable. It documents that audio children quite resourcefully drew more often on their repertoires of general knowledge and personal experience as sources for visualizations of story content. Often this was the case even when rich descriptive language was availabe to them in the text. Film children on the other hand, relied almost exclusively on inside-story visual and visual-textual sources.

Interestingly, children in all conditions also answered source questions by making <u>further inferences</u> about the story. One consistent trend was observed. In 3 out of 4 drawing tasks, audio children more than film children described the source of their visualizations in terms of a further <u>physical</u> inference (Task 3: χ^2 (2)=8.90, p .01; Task 4: χ^2 (2)=9.30, $p \leq .01$). Task 2 approached statistical significance (χ^2 (2)=5.77, $p \leq .06$). For example, in describing the source for their drawing of the wife (Task 3), audio children typically speculated about what she would have looked like and made physical inferences: e.g., "I knew she looked like that because she would probably have a fancy nightgown and probably have bags under her eyes... and curlers..." In the absence of explicit visual content and lengthy description, these children "reasoned" their visualizations to life.

Interestingly, film children were more likely to identify an imagery source for their wife drawing using a psychological inference about her

emotional state, e.g., "I knew she looked like that because she was really angry." or "She wanted it real bad." Though not significant, forty-seven percent (47%) of film children as opposed to 27% of audio children responded this way. Perhaps for children who have recent access to vivid visible information about characters, further speculation about their internal state follows more naturally. Despite audio children's more frequent use of outside-story and physical inference sources, they also drew frequently on text and auditory content available within the story. For example, (Task 2) "I knew it looked like that because they said he was fishing in the sea and he caught a big fish that was magic and granted wishes." (text); (Task 3) "I knew she looked like that because she was yelling it out." (auditory).

Time to Draw

Anovas for all four drawing tasks examining differences in the amount of time it took for children to complete their drawings were non-significant.

Literal versus Non-Literal Description: Audio Conditions

1) Volunteered Evidence

Although the descriptive language passages added to the story could serve as appropriate imagery sources for the four story drawings, only a small percentage of children who heard either the literal (19%) or non-literal (14%) descriptions referred to them in their source responses.

The extent to which audio children called on the verbal descriptive passages as bases for story-related inferences has already been reported. For any inference, there were never more than two children who indicated a basis that directly relied on descriptive language manipulated in the two versions.

Interestingly, many drawings reflected information presented in language descriptions (e.g., long noses, hats). Perhaps some children

encode description information visually. If so, it may have been difficult for them to later translate the information into verbal recollections of specific text. There were no drawings where non-literal information appeared in its literal form, e.g., there were no drawings of a wife with a wolf's face. Presumably, this means that by the age of 10, all children are aware that figures of speech are not meant to be taken literally. However, that children didn't attend to the language in the first place cannot be ruled out as an alternative explanation.

2) Solicited Evidence

Recall Task: The mean percent of children who correctly recalled any descriptive language across all tasks was 28%. There was a consistent non-significant trend for literal audio children to outperform non-literal audio children on 3 tasks (Task 2, 3, and 4), perhaps because literal language was more familiar and meaningful for children. (Task 1 data is difficult to interpret. Because there was more information in this description more children in both groups received credit.)

Recognition Task: Predictably, the mean percent of children who correctly recognized any descriptive language across all tasks was higher (73%) than for recall tasks. T tests between mean recall and recognition scores for combined radio conditions confirmed that the large majority of all children found it easier to recognize than recall the language descriptions they had heard (Task 2: t (29)=3.64, $p \leq .001$; Task 3: t (27)= -6.97, $p \leq .001$: Task 4: t (29)=4.47, $p \leq .001$). The Task 1 test indicated the same trend, although it did not reach statistical significance. There were no condition effects in children's ability to recognize description.

Although their recall was limited, the majority of children in both audio conditions recognized the descriptive language they had heard. Several factors deserve consideration in interpreting why children did not recall

more of the descriptive language. First, the descriptive language manipulated in this story may have been too brief and subtle to command children's attention. Second, verbal descriptions stopped the ongoing progress of the story's plot and many children may have experienced these as intrusions or "resting places" where they could momentarily suspend their attention. Finally, perhaps children brought up to appreciate stories on film and television have little practice attending to aural description. There is some evidence that children's ability to understand stories presented aurally varies more widely than does their comprehension of comparable television material (Char & Meringoff, 1981).

To focus again on the inherent characteristics of the medium, description in aural stories almost always halts the progress of story action or dialogue and so may be experienced as intrusive by children who do not appreciate it. Further, aural description is rarely as redundant as visual depiction, where a character or setting is likely to be shown again and again during the course of a story. To test these assumptions, future research will need to compare children's recall of material from media presentations that are more extensively controlled for analogous visual and descriptive content.

General Conclusions and Discussion

The findings from this study document several commonly held beliefs about children's visualization process as they encounter stories presented in different media. The findings also suggest several less obvious ways to interpret differences in children's media experiences.

There is a longstanding assumption that children actively imagine rich and fanciful story images as they listen to story description. That is, many think of the attentive listener as a producer of "videotapes-in-the-head." The other side of this position holds that children who view film or television become passive receptacles for story images; They simply "sit and watch" without being stimulated to use their minds in any visually imaginative way. Our research suggests a somewhat different perspective.

On the one hand, children who listened to stories did indeed display a high degree of resourcefulness in drawing and inferring about story content. These children, more often than viewing children, went outside the story and drew upon their general knowledge and personal experiences as the fabric for story visualizations, drawings, and inferences. In many instances they also attended to subtle inside-story cues, such as character accents and voice qualities, and applied them when making inferences about story setting and character attributes. However, we found that children in the audio conditions produced images of story content that were, in many instances, more conventional and prototypical than those of children who had viewed the film. Also, in contrast to general assumptions about story description, the listening children in our study largely ignored select verbal description of visual content offered in the film. It was apparently very elusive for these children. It also did not seem

to matter whether these descriptions were presented in literal or non-literal language. There were even cases where listening children entirely disregarded descriptive language and included content in their drawings that was inconsistent with that offered in the story. Whether because they have little practice with the aural medium, or because the descriptive language in these versions was not lengthy or rich enough to be more memorable, these children's story imagery and understanding seemed little influenced by this prose.

Generally, children who viewed the film appeared to rely to a great extent on the visual and visual-textual information they had seen when they were asked to visualize, draw, and make inferences about story content. While they, too, occasionally drew upon their outside-story experiences to justify inferences, they more often used the visual inside-story information they had seen and remembered. These children demonstrated a particular adeptness at "reading" the film's visual imagery for meaning. As predicted, we found that they could derive important information about story setting, time and character affect from observation of character costume and facial details. Chatman's observations (1980) about the density of visual depiction appear to have been borne out. Film children apparently found myriad visual "reference points" to call upon as they interpreted the story. Indeed, the specificity of children's references points, in their detail and in time, was particularly dramatic to observe. We also noted that children who had viewed the film were more likely than others to include the film's unusual viewing perspectives and rich details of character appearance and expression in their drawings.

Perhaps the lesson here resides in an appreciation of the strengths and weaknesses in any medium's presentation of a story. For example, while aural presentations call upon children to bring to bear their own

experiences in constructing images and meaning for story content, children also fall back upon prior information in responding to story content and perhaps take less advantage of what is given. While stories on film may focus children's attention more directly on explicit and visualized events, they may also challenge children to visually imagine and draw related content in non-stereotypic ways.

Several methodological considerations deserve mention. No doubt there is variation in the degree to which children visualize story content presented in any medium. Our measures of this process were simple and imperfect. For most children at this age, drawing is a little practiced, little tutored skill. For this reason, individual differences in children's performance may well obscure observation of between-group differences.

It may also be the case that the predominant internal imagery of children who listen to stories is not even visual. Perhaps it is more purely auditory, e.g., the [illegible] is heard in one's head, not seen. More purely aural response measures might be more appropriate for tapping the perceptual imagery children generate from listening to stories.

Future research comparing media presentations also will need to confront the difficult issue of stimulus comparability. The challenge is to find story materials that adequately reflect the full potential of a given medium, while also affording the greatest possible degree of experimental control and comparability. Only then will researchers be able to generalize about the effects of media presentations on children's story experiences and offer findings of value to the people who produce those presentations for children.

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The Fisherman and His Wife: Interview

Name: **Class:**

Condition: **Age:**

Date:

Before Story

Familiarity: There's a story I would like you to listen to/watch. It's named The Fisherman and His Wife. Do you know that story?

( )no
It's about a fisherman who catches a magic fish who grants wishes. Does that sound familiar?

( )yes What is it about?

How do you know that story? (film, book, record...)

How long ago did you hear/see the story? Where?

Do you remember pictures from the story?

( )no
( )yes What pictures?

After you listen to/watch the story today, we'll do some things with pictures and talk some about it.

Present Story

OK. Are you ready for the story? Are you comfortable?
(Note attention level and behavior.)

Post-Story

Top-of-the-Mind: The first thing I'd like you to do is close your eyes for just a minute. Is there one picture from the story that stands out right now in your mind -- you know, that you see in your mind?

( )no
( )yes What do you see?

(Where in the story is that -- beginning, middle, end?)

Good.

Visualizations: Now I'm going to ask you to imagine how some other things in the story look. You can close your eyes at any time if it helps.

1) Think about what the fisherman looked like in the story you just heard/watched... until you can see him in your mind. OK. Hold that in your mind for just a minute and think about a TV screen -- you know how pictures on TV can be really clear and in-focus or fuzzy and snowy? Is the fisherman in your mind clear or fuzzy?

( )clear
( )fuzzy

OK. Now I want you to draw a picture of the fisherman, as best you can, the way he looks in your mind. (place paper and pencil in front of child) Just draw the fisherman...it doesn't have to be a perfect drawing -- just what you see in your mind.

_____latency (from end of instructions to pencil on paper)

(After 3 minutes:) We are going to do some other things so finish up.

_____time

A1) Let's look at your picture. It's sometimes hard to draw things just the way you imagine they look. Tell me is there anything in your drawing that you would like to change, add, or leave out so that it's closer to the way you imagine it?

( )no difference
( )yes (have child describe)

(take drawing away)

B1) How did you know to imagine the fisherman that way? (How did you know it looked like that?)

C1) **Setting:** Where do you think the fisherman is from -- what country?

How do you know?
What makes you think that?

Period: What time do you think the fisherman lives in -- the time of Hansel and Gretel (Cinderella), in the time of Dorothy in the Wizard of OZ, or in the time of Superman? (make sure child is familiar with each alternative -- establish chronological sequence of alternatives)

How do you know the fisherman lives in that time?

2) Good. Now think about the fisherman fishing... until you can see him doing that in your mind. Is that fuzzy or clear?

( )clear
( )fuzzy

OK. Now I want you to draw the fisherman fishing, as best you can, the way you see it in your mind. (place paper in front of child)

_____latency

(After 3 minutes:) Try to finish up.

_____time

A2) Is there anything in your drawing that you would like to add, leave out, or change so that it is closer to the way you imagine it?

( )no difference
( )yes (have child describe)

(remove drawing)

B2) How did you know to imagine the fisherman fishing that way? (How did you know it looked like that?)

C2) Net: Was it hard or easy for the fisherman to throw the net?

( )easy
( )hard

How do you know?

Size: If the fisherman came into this room right now, what size do you think he would be? ( )large, ( )average, or ( )small? (man)

How do you know?
What makes you think that?

Age: Do you think of the fisherman as ( ) a young man -- between 20 and 30, as ( )a middle aged man -- between 30 and 50, or as ( ) an old man -- 50, 60 or older?

How do you know?

3) Good. Think about the part in the story when the wife makes her last wish -- when she tells her husband that she wants to be like unto God. Think until you see in your mind how she looks when she tells her husband that last wish. Is that clear or fuzzy?

( )clear
( )fuzzy

OK. Now I want you to draw a picture of the way the wife looks in your mind when she tells her husband that last wish. (place paper in front of child)

_____latency

(After 3 mins:) Finish up.

_____time

A3) Is there anything in your drawing that you would like to leave out, change, or add so that it is closer to the way you imagine it?

( )no difference
( )yes (have child describe)

(remove drawing)

B3) How did you know to imagine her that way? (How did you know she looked like that?)

C3) Affect: How do you think the wife felt when she made that last wish? (gauge intensity of feeling from 1-lowest to 3-highest.) ( )1 ( )2 ( )3

How do you know?

4) You're doing a good job. We are almost done. Think about the last time the fish said Go home...until you can see it in your mind. Is that fuzzy or clear?

( )clear
( )fuzzy

OK. Draw the fish then...the way you see it in your mind. (place paper)

_____latency

(After 3 mins:) Please finish up.

_____time

A4) Is there anything in your drawing that you would like to change, add, or leave out so that it is closer to the way you imagine it?

( )no difference
( )yes (have child describe)

(remove drawing)

B4) How did you know to imagine it that way? (How did you know it looked like that?)

C4) How did you know the fish was special? (probe for more than one reason)

5) Film Children Only:
Remember all those trips that the fisherman made back and forth to the sea? Did you learn anything more about him just from the way he looked or did you not pay much attention to it?

( )yes
( )no attention

What did you learn?

anything about his feelings?
anything about his body?

How did you know that? (try to locate walk -- beginning, middle, end?)

Thank You. (debrief)

For Audio Children Only:

Aided Recall: I have just a few more questions for you. Some of them you may have already answered for me but this is a chance for you to tell me anything else you might not have said before...

1) Did it say or describe anything in the story about how the fisherman looked?

Anything about his face?
Anything about his clothes?

2) Did it say or describe anything in the story about how it looked (when he fished; when he cast his net)?

3) Did it say or describe anything about how the wife looked when she made the last wish?

Anything about how her face looked?

4) Did it say or describe anything about how the fish looked the last time it said go home? (probe for more than one response)

Recognition Task: (have child select appropriate description from randomized choices...notecorrect or incorrect and if incorrect, note selection)

	Correct	Incorrect
1)		
2)		
3)		
4)		

Thank you. (debrief)

The Fisherman and His Wife
Baseline Drawing Instructions
Watertown, MA

On back of each paper put name and number.

1. "Draw a fisherman. Don't make him fishing, just draw him, what he looks like." (After 3 minutes: "Finish up; we are going to do some other things.")

2. "Draw the fisherman casting a net."

3. "Draw a woman who has everything she wants in the world and is 'demanding' she be given one more thing." (If children want to know what she is demanding: "That's not important. Concentrate on drawing her, what she she would look like when she is asking for that last thing."

4. "Draw a magic fish coming up out of the water."

Post-Drawing Questions

1. "Have you ever heard of a story named The fisherman and his wife?" (yes or no)

2. "Do you know the story well enough to tell it really well to a friend?" (yes or no) ("If no, put down your pencil and wait.")

3. "If you know the story, where do you know it from?" (book, film, record, other?) (school, library, home...)

4. "How long ago did you hear this story?" (this year, last year, two years ago, etc.)

Appendix C

Scoring Categories for Drawings
(Except where otherwise indicated, drawings were scored for the inclusion or non-inclusion of features.)

Task 1 Character Appearance - Draw the Fisherman

1) face only or full figure

2) face or figure orientation (frontal, profile right or left, three-quarter, other)

3) size of figure (in inches)

4) shoes (none, wooden, other, e.g., boots, indistinguishable)

5) hat

6) long nose

7) degree of facial elaboration
(essential features missing; eyes, nose, mouth; features in addition to eyes, nose, mouth, e.g., eyebrows, wrinkles, etc.)

8) straight hair

9) beard

10) elaborated costume detail (e.g., buttons, ruffles, stripes, etc.)

11) context (e.g., baseline, sun, water, clouds, etc.)

Task 2 Character Movement - Draw the Fisherman Fishing

1) figure orientation (frontal, profile right or left, three-quarter, other)

2) size of figure (in inches)

3) pole, full net, or "butterfly" net

4) net size (across longest expanse, in inches)

5) net's lateral position (overlapping body or away from body)

6) net's height in relation to body (above, top, mid, bottom, below)

7) arms (up, out, down)

8) hands holding net (2-holding, 1-holding, 0-holding)

9) net in relation to water (outside or crossing waterline)

10) amount of filled in space on the paper (less than half, half, more than half)

11) water

12) jaggedness of waterline (slight, medium, great)

13) context

14) shoreline, hill, pier, boat, or "in limbo", e.g., no baseline

Task 3 Character Affect - Draw the Wife

1) face only or full figure

2) face or figure orientation (frontal, profile right or left, three-quarter view, other)

3) figure size (in inches)

4) words

5) facial features

6) mouth (open or closed)

7) mouth line (smile, frown, straight, other)

8) teeth

9) eyebrows (none, normal, downward)

10) gestural indicators of affect (e.g., hands on hips, pointing finger, etc.)

11) independent judgments of overall expression (happy, angry, indistinguishable, other)

12) elaborated costume detail (e.g., crown, ruffles, wand, etc.)

13) context (e.g., bed, window, table, etc.)

14) orientation of bed (frontal or profile)

Task 4 Point of View/Special Effects - Draw the Fish

1) face only or full figure

2) face or figure orientation (frontal, profile right or left, three-quarter, other)

3) size (across longest expanse, in inches)

4) words

5) glow

6) scale detail

7) magic accessories (e.g., top hat, crown, wand, etc.)

8) amount of filled in space on the paper (less than half, half, more than half)

9) water

10) repetition of waterline

11) jaggedness of waterline (slight, medium, great)

12) other content (e.g., person, boat, land, etc.)